

CLAIMS

1. A process for producing a crude oil having lowered unsaponifiable matter content and/or ester-type sterol content and comprising a highly unsaturated fatty acid as a constituent fatty acid, characterized in that a microorganism capable of producing a fat or oil comprising an unsaturated fatty acid as a constituent fatty acid is cultured in a medium containing a nitrogen source concentration of 2 to 15% within a culture tank equipped with an agitation impeller satisfying the requirement that the ratio of the diameter of agitation impeller (= d) to the inner diameter of the culture tank (= D) is  $d/D = 0.30$  to  $0.6$ .

2. The process according to claim 1, wherein the ratio of the diameter of agitation impeller (= d) to the inner diameter of the culture tank (= D) is  $d/D = 0.34$  to  $0.6$ .

3. The process according to claim 1 or 2, wherein the nitrogen source contains a nitrogen source which has been sterilized at a pH of not more than 5.

4. A process for producing a refined fat or oil, characterized by comprising refining the crude oil produced by the process according to any one of claims 1 to 3.

5. The process for producing a crude oil comprising a highly unsaturated fatty acid having lowered unsaponifiable matter content and/or ester-type sterol content as a constituent fatty acid according to any one of claims 1 to 3, or the process for producing a refined fat or oil according to claim 4, characterized in that not less than 70% of the fat or oil comprising said highly unsaturated fatty acid as the constituent fatty acid is accounted for by a triglyceride.

6. The process according to any one of claims 1 to 5, wherein the highly unsaturated fatty acid constituting the fat or oil is  $\gamma$ -linolenic acid (18:3  $\omega$ 6), dihomo- $\gamma$ -

linolenic acid (20:3  $\omega$ 6), arachidonic acid (20:4  $\omega$ 6),  
7,10,13,16-docosatetraenoic acid (22:4  $\omega$ 6),  
4,7,10,13,16-docosapentaenoic acid (22:5  $\omega$ 6),  $\alpha$ -  
linolenic acid (18:3  $\omega$ 3), 6,9,12,15-octadecatetraenoic  
5 acid (18:4  $\omega$ 3), 8,11,14,17-eicosatetraenoic acid (20:4  
 $\omega$ 3), eicosapentaenoic acid (20:5  $\omega$ 3), 7,10,13,16,19-  
docosapentaenoic acid (22:5  $\omega$ 3), 4,7,10,13,16,19-  
docosahexaenoic acid (22:6  $\omega$ 3), 6,9-octadecadienoic acid  
(18:2  $\omega$ 9), 8,11-eicosadienoic acid (20:2  $\omega$ 9), or 5,8,11-  
10 eicosatrienoic acid (Mead acid: 20:3  $\omega$ 9) or a  
combination of two or more of them.

7. The process according to any one of claims 1 to  
6, wherein the microorganism is one belonging to the  
genus *Mortierella*, *Conidiobolus*, *Pythium*, *Phytophthora*,  
15 *Penicillium*, *Cladosporium*, *Mucor*, *Fusarium*, *Aspergillus*,  
*Rhodotorula*, *Entomophthora*, *Echinosporangium*, or  
*Saprolegnia*.

8. The process according to any one of claims 1 to  
7, wherein said microorganism is one belonging to the  
20 genus *Mortierella*, subgenus *Mortierella*.

9. The process according to claim 8, wherein the  
microorganism belonging to the subgenus *Mortierella* is  
the species *alpina* belonging to the genus *Mortierella*.

10. A crude oil characterized by having an  
25 unsaponifiable matter content of not more than 2.2% by  
weight produced by the process according to any one of  
claims 1 to 9.

11. A refined fat or oil produced by refining the  
crude oil according to claim 10.

30 12. A crude oil characterized by having an ester-  
type sterol content of not more than 1.0% by weight  
produced by the process according to any one of claims 1  
to 9.

13. A refined fat or oil produced by refining the

crude oil according to claim 12.

14. A crude oil comprising a fat or oil having lowered unsaponifiable matter content and/or ester-type sterol content comprising, as a constituent fatty acid, a highly unsaturated fatty acid, characterized in that the unsaponifiable matter content of the fat or oil is not more than 2.2% by weight.

15. A refined fat or oil produced by refining the crude oil according to claim 14.

16. A crude oil comprising a fat or oil having lowered unsaponifiable matter content and/or ester-type sterol content comprising, as a constituent fatty acid, a highly unsaturated fatty acid, characterized in that the ester-type sterol content of the fat or oil is not more than 1.0% by weight.

17. A refined fat or oil produced by refining the crude oil according to claim 16.

18. A general food and drink, a functional food, a nutrition supplement, a formula for premature babies, a formula for mature babies, a food for infants, a food for expectant and nursing mothers, or a food for aged persons, comprising the crude oil and/or the refined fat or oil according to any one of claims 10 to 17 incorporated therein.

19. A therapeutic nutrition food comprising the crude oil and/or the refined fat or oil according to any one of claims 10 to 17 incorporated therein optionally together with a neutral carrier suitable for oral, intrarectal or parenteral administration.

20. A food for animals or fishes, comprising the crude oil and/or the refined fat or oil according to any one of claims 10 to 17 incorporated therein.

21. A pharmaceutical composition, comprising the crude oil and/or the refined fat or oil according to any one of claims 10 to 17 incorporated therein.

22. A pharmaceutical composition prepared by using the crude oil and/or the refined fat or oil according to

any one of claims 10 to 17 as a raw material.